# REPORT RESUMES

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## THE SELECTION, TRAINING, AND PLACEMENT OF BLIND COMPUTER PROGRAMMERS.

ASSOCIATION FOR COMPUTING MACHINERY, NEW YORK, N.Y
AMERICAN ASSN. OF WORKERS FOR THE BLIND

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FINDINGS OF A 2-YEAR STUDY ON THE SELECTION, TRAINING, AND EMPLOYMENT OF BLIND PERSONS IN THE COMPUTER RELATED PROFESSIONS ARE REPORTED FOR USE AS A GUIDE FOR THE TEACHER OF COMPUTER PROFESSIONALS, THE EMPLOYER WHO SEEKS TO MAKE USE OF EMPLOYEES' SKILLS, THE REHABILITATION WORKER WHO WILL GUIDE THE BLIND PERSON, AND THE BLIND PERSON WHO CHOOSES THIS PROFESSION. PROGRAMMING FOR BLIND PERSONS IS MADE POSSIBLE BECAUSE MOST HIGH SPEED PRINTERS CAN BE MADE TO EMBOSS A READABLE BRAILLE WITHOUT UNDUE MODIFICATIONS. INDIVIDUALS SELECTING THIS WORK SHOULD HAVE THE GENERAL AND INTELLECTUAL QUALITIES FOR WHICH COLLEGE TRAINING IS USUALLY RECOMMENDED, AND THE INDEPENDENCE TO FUNCTION IN COMPETITION WITH SIGHTED INDIVIDUALS. OTHER REQUIREMENTS CONCERN MEDICAL AND OPHTHALMOLOGICAL FACTORS, EDUCATION, PERSONAL ADJUSTMENT AND MOBILITY, COMMUNICATIONS ABILITY, INTERESTS, AND GOALS. A THOUSAND HOURS OF TRAINING SHOULD BE SUFFICIENT TO PREPARE AN AVERAGE BLIND STUDENT FOR THE JOB OF CODER-PROGRAMER. THE JOBS OF PROGRAMMER ANALYST AND SYSTEMS ANALYST REQUIRE MORE TIME AND PROBABLY COLLEGE TRAINING. TRAINING MATERIALS, PROCEDURES, STANDARDS, GUIDELINES FOR JOB INTERVIEWS, AND RESPONSIBILITIES FOR PLACEMENT ARE DISCUSSED. (PS)

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# THE SELECTION, TRAINING, AND PLACEMENT OF BLIND COMPUTER PROGRAMMERS

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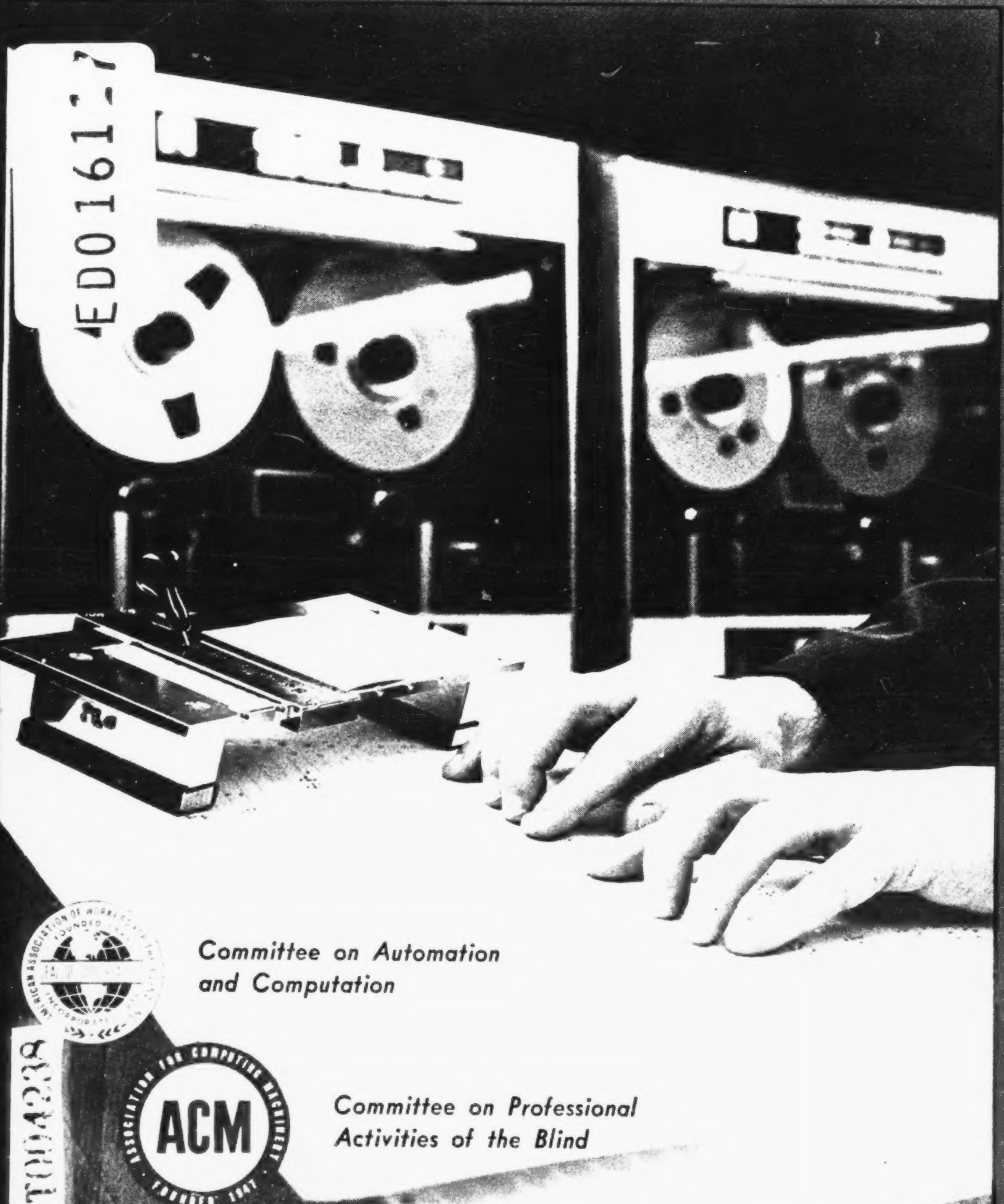

Committee on Automation
and Computation

Committee on Professional
Activities of the Blind

VT004238

# THE SELECTION, TRAINING, AND PLACEMENT OF BLIND COMPUTER PROGRAMMERS,

Committee on Professional Activities of the Blind
of the
Association for Computing Machinery, New York, N.Y.
in Co-operation with the
Committee on Automation and Computation
of the
American Association of Workers for the Blind, Washington, D.C.

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headquarters.

Committee on Professional Activities of the Blind
Department of Applied Mathematics
and Computer Sciences
Washington University
St. Louis, Missouri

# PREFACE

Computer workers are most aware of the many problems in communication which make it so very difficult to pass on precise information about their activities and the knowledge and skills involved in their work to those in other disciplines and professions. For this reason the Association for Computing Machinery has continuously concerned itself with the education of those entering and working in this field.

When technical developments made it possible for blind persons to become engaged in professional computer work, the Association undertook to provide special guidance for them. While, on one hand, the blind person may be peculiarly suited for work with computers, on the other hand he himself as well as his rehabilitation counselor tends to be (at least still at this time) woefully ignorant of the demands of the profession toward which he is heading, what preparations he ought to receive, what training ought he have, and how he can make a livelihood working with and around computers. Accordingly, the President of the Association for Computing Machinery appointed a committee in 1963 to examine the professional problems of blind persons and to make recommendations both to the Association for Computing Machinery and to proper authorities concerning the various problems associated with the integration of the blind individuals in the computer profession. It was clear from the first deliberations of this committee that its major job ought to be to establish and maintain a dialogue between the various disciplines and resources that were involved. This dialogue, or perhaps better multilogue, had to be established between a profession that rested largely on the exercise of logic, mathematics, and engineering concepts and individuals whose major concern could perhaps be described best to lie in areas of social work and education. To deal better with obvious obstacles to communication, the Committee invited participation from the Vocational Rehabilitation Administration, State Rehabilitation Offices, related professional organizations dealing with problems of the blind, concerned individuals, and representatives of blind workers within the industry itself. By discussion among its members and by study of the current practices of selection, training, and employment of blind programmers, the Committee hoped to create a common understanding among basically different professions for the profit of all concerned. To enable this understanding to grow and flourish in the future, the President of the American Association of Workers for the Blind appointed a Committee on Automation and Computation to work along with whe Association for Computing Machinery.

The present report describes the Committee's findings concerning the selection, training, and employment of blind persons in the computer related professions. The report is designed as a guide for the teacher concerned with education of computer professionals, the employer who seeks to make use of skills presented to him, the rehabilitation worker who in many ways must select and choose as well as guide the education of blind persons from youth to their professional fulfillment, and above all the blind person who wishes to seek a livelihood in this profession. Members of the Committee have spent two years studying different training ventures, their product, and the general problem of training and selection in the industry before presenting this report. We hope now that the results of our deliberations will be of use to the many groups to which it is addressed.

The work of the Committee was made possible by the cooperation of many individuals. Subcommittees and other individuals who were responsible for specific subjects and fact-finding procedures are listed at the end of this report. The necessary funds to make it possible for the Committee to pursue its work have come forward through the efforts of a number of persons who wish to remain anonymous and to whom the Committee gratefully acknowledges its debt.

T.D.S.

St. Louis, Missouri 1966

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## I. THE BLIND PERSON AS A PROFESSIONAL PROGRAMMER

It is unfortunate that the term "programmer" is used so widely and covers such a multitute of activities. There are actually a variety of professions covered by this name which are to some extent related but in many ways different from each other. The situation would be not too dissimilar if everyone working in a radiology department, from the X-ray technician on to the radiophysicist, was addressed by the term "radiologist". Some people known as programmers do jobs which are, at best, on a technician level while others apply to their work the creativity and originality expected from a person holding a higher degree.

### Types of Programming Jobs

It may be well to introduce at this point a distinction between different types of programming jobs. The lines which we propose here are not to be understood as firm boundaries but rather as successive levels of skill.

At the lowest of these levels is the coder-programmer. This individual fills out (codes) the basic program outlines supplied to him by the more skilled business or scientific programmer. He provides instruction sequences that enable the machine to perform relatively simple sets of operations. Most likely he has no knowledge of the overall program requirements and can code usually only in a single assembly or compiling language. A somewhat more lengthy definition of the coder (also called junior programmer or detailed programmer) is found in the Dictionary of Occupational Titles (Third Edition, Superintendent of Documents, Government Printing Office, Washington, D.C.):

> PROGRAMMER, DETAIL (clerical); junior programmer; program coder. Selects symbols from coding system peculiar to make or model of digital computer and applies them to successive steps of completed program for conversion to machine processable instructions: Reads and interprets sequence of alphabetic, numeric, or special charcters from handbook or memory for each program step to translate it into machine language or pseudo (symbolic) code that can be converted by computer processor into machine instructions. Records symbols on worksheet for

transfer to punch cards or machine input tape. Marks code sheet to indicate relationship of code to program steps to simplify debugging of program. Confers with programming personnel to clarify intent of program steps. Usually works as understudy to PROGRAMMER, BUSINESS, performing such additional tasks as converting flow charts and diagram of simple problem from rough to finished form, or making minor changes in established programs to adapt them to new requirements.

There are two aspects about this job that should be kept in mind. First, the individual with minimal training usually starts at the level of a coder-programmer and works his way up into a more skilled and demanding job. In this way the coding job may be viewed as part of on-the-job training. Second, because of the relatively low demand on his intellectual abilities the coder's job may be the final resting place for individuals of lesser skill who have been trained to do just that and no more. It is very often the practice of companies, when automating their office procedures, to transfer clerks with seniority to this type of position. It takes a relatively small amount of training and the familiarity of the clerk with company procedures is usually extremely helpful. But, because companies put their own replaced employees into this position, the coder's job as such is usually not available. The blind person who is trained with an eye toward occupying the position of a coder will find comparatively few opportunities for work.

At the next level of skills is the business programmer and his counterpart the engineering and scientific programmer.

The Dictionary of Occupational Titles describes the job of the business programmer as follows:

PROGRAMMER, BUSINESS (profess. & kin.); digital-computer programmer. Converts symbolic statements of business problems to detailed logical flow charts for coding into computer language and solution by means of automatic data processing equipment: Analyzes all or part of workflow chart or diagram representing business problem by applying knowledge of computer capabilities, subject matter, algerbra, and symbolic logic to develop sequence

> of program steps. Confers with supervisor and representatives of departments affected by program to resolve questions of program intent, output requirements, input data acquisition, extent of automatic programming and coding use and modification, and inclusion of internal checks and controls. Writes detailed logical flow chart in symbolic form to represent work order of data to be processed by computer system, and to describe input, output, and arithmetic and logical operations involved. May convert detailed logical flow chart to language processable by computer. Devises sample input data to provide test of program adequacy. Prepares block diagrams to specify equipment configuration. Observes or runs tests of coded program on computer, using actual or sample input data. Corrects program errors by such methods as altering program steps and sequence. Perpares written instructions (run book) to guide operating personnel during production runs. Analyzes, reviews and rewrites programs to increase operating efficiency or adapt to new requirements. Compiles documentation of program development and subsequent revisions. May specialize in writing programs for one make and type of computer.

In a somewhat similar fashion the Dictionary of Occupational Titles describes the job of the engineering and scientific programmer:

> PROGRAMMER, ENGINEERING AND SCIENTIFIC (profess. & kin.); programmer, technical. Converts scientific, engineering, and other technical problem formulations to format processable by computer: Resolves symbolic formulations, prepares logical flow charts and block diagrams, and encodes resolvent equations for processing by applying knowledge of advanced mathematics, such as differential equations and numerical analysis, and understanding of computer capabilities and limitations. Confers with engineering and other technical personnel to resolve problems of intent, inaccuracy, or feasibility of computer processing. Observes or operates computer during testing or processing runs to analyze and correct programming and coding errors. Reviews

results of computer runs with interested technical personnel to determine necessity for modifications and rerun. Develops new subroutines for a specific area of application or expands on applicability of current general programs, such as FORTRAN, to simplify statement, programming or coding of future problems. May supervise other programming personnel. May specialize in single area of application, such as numerical control, to develop processors that permit programming for contour controlled machine tools in source oriented language.

Both the positions of business and engineering or scientific programmer can be trained for directly, although, it is unlikely that anyone will be hired for that position without having had some supervised experience. The distinction between a coder and a programmer should be kept in mind when evaluating training possibilities for prospective programmers.

There are advanced technical jobs beyond that of programmer which are intimately concerned with programming but for which direct training is, at present, not a likely possibility. These are the positions of systems analysts for business or electronic data processing and systems analysts for engineering and scientific work.

Systems analysts resolve the user's problems by devising appropriate systems of computer operations. Very often such work entails a thorough knowledge of the user's work requirements. In many ways, these positions need individuals who are extremely inventive. They must be able to learn enough about the user's problem and work in a short time so that they can devise systems of information flow or computation which will resolve them. Very often this means a better grasp of the problem than the user has. The analyst must, of course, have a firm knowledge of programming so that he can bring to bear the most efficient computer operations to the solution of the customer's problem.

Not unrelated and perhaps undistinguishable from either the systems analyst for business or scientific affairs is the programmer analyst who deals purely with computer systems. He is a person who devises and designs the basic software (i.e. programming systems and logical constructs) which is used by the programmer in the performance of his job. Programming languages are written by such individuals. They design compilers. They design and write systems that enable computers to "batch" a series of jobs or perform more than one job simultaneously in a multiple programming fashion, and so on. Of all programming skills this is probably the highest paid and the greatest in demand.

## Special Aids and Techniques

A few words might be appropriate now to review briefly the way in which the blind person as contrasted to the sighted, fits in as a programmer.

Programming for blind persons is made possible essentially because most high speed printers can be made to emboss a readable braille without undue modifications. (The basic process by which this embossing is done has been described by Sterling, et al, Professional Computer Work for the Blind. Communications of the Assoc. Comp. Mach. 7: No. 4, 228-231, 1964.)

Because of the property that enables the high speed printer to emboss a readable braille at a very high rate of speed the blind programmer can obtain listings of programs, diagnostics, dump routines, and any other type of output in braille rather than in print. Because the translation process is extremely rapid and does not require costly alteration of machines, the blind programmer is almost at par with the sighted in obtaining readable output.

What disadvantages there may be in the somewhat slower reading of braille and the lesser ease in perusing large lists of brailled materials are compensated to a substantial degree by the blind individual's constant training in memory organization and spatial orientation. It has been shown that these two habits, although acquired out of sheer necessity, enable the blind programmer to obtain with ease an overview of the program he is to write and maintain a steady flow of organization. (The Blind as Computer Programmers. Rehabilitation Record 7: 7-10, 1966) Blind programmers can produce programs at any level of complexity in the same time as sighted programmers.

Other than obtaining his printout in braille, the blind person occasionally uses a number of other aids to help him perform his job in complete independence.

There are a number of different instruments available which enable the blind person to read IBM cards and/or punched paper tape. The programmer will very seldom be called upon to read cards or tape; however, there are occasions when he may want to check a particular column on a program card or make corrections on it.

The programmer is very seldom if ever required to debug his programs on the computer console. However, console debugging does not represent a particularly difficult problem for the blind programmer if he is trained to use a light probe.

Preparations of programs for the punch operator can be made routinely by the blind person who may type his programs directly or dictate them onto tape and have them transcribed by a clerk.

Documentation of programs is becoming less of a job as more user oriented languages are being used. Documentation very often can become part of a program. Where it is not, the programmer (whether blind or sighted) produces such documentation as a type script or a set of job directions.

Flow diagrams are constructed by the blind programmer although they may differ in appearance from those to which his sighted colleague is accustomed. If a conventional flow chart is to be produced, the blind Programmer can direct a typist or clerk to produce such a diagram from notes. The high speed printer can also be used to emboss a conventional flow chart. (For more information see Sterling, et al, The Role of the Blind in Data Processing. Proceedings of the Third Annual Computer Personnel Research Conference, 1965.)

The systems that emboss information for the blind programmer on the high speed printer, the use of the card reader and light probe, techniques for flow charting, documentation, and job direction, and many others make up the technical armamentarium of the blind programmer. In any good training program he will be taught how to use these tools so as to maintain himself as an independent and valuable employee. There is no reason why a blind person having been properly trained in the tools of his trade cannot become as independent (or dependent) as is his sighted colleague.

## A Word About Responsibilities for Applicances and Guide Dogs

Every blind person requires some special appliances, aids, devices, services and the like in order to function and compete in the sighted world. It is the responsibility of each person to make sure that the use of these special devices and aids or dogs does not impinge in any way on the rights or interfere with the convenience or safety of his co-workers. Examples of such infringements could be improper placement of special appliances so that extension cords cut across access ways and interfere with normal activity in an office, leaving a cane where others could trip over it or where it may fall into their way or improper control of a guide dog so that it interferes or becomes annoying to others. Animals of any kind raise a number of potential, real, as well as imagined problems for computing installations as well as for the blind programmer who cannot do without them at his place of employment. Some manager may be reluctant to permit the presence of a dog in the computing center. This should be understood as a precaution rather than an expression of hostility against the employee or his dog. A blind candidate should keep in mind that reliance on a dog for mobility at work may curtail employment opportunities in a computer installation. If he does need a dog for mobility at his place of employment, he must have a properly trained animal that he can control expertly in the modern office environment.

## II. THE SELECTION OF CANDIDATES FOR TRAINING

Training in any field is an investment. The ability and interest of the student, as well as his ultimate employability, are all factors which should be considered by the training institution, by the agency which supports the student's training, and by the student who invests his time and effort and perhaps also his financial substance into a training venture. Yet while factors determining occupational choice are certainly decisive for the individual applicant and while a rehabilitation agency must consider some individuals for some type of training and others for a different type of training, the final decision on the acceptability of a student ought to rest with the training facility, although notification of acceptance or rejection is often done best through the applicant's rehabilitation agency. Here are people who by experience and training should be able to judge and evaluate all the information available about an applicant and advise the agency and the candidate of his suitability for training and placement. Therefore, complete information about the applicant should be provided to the training facility either by the referring agency in accordance with these recommendations or by the candidate himself.

### General Guidelines

Selection decisions concerning an occupation or selection of individuals for specific training are never cut and dried affairs. In many ways it is difficult to predict whether an individual will be suited to a career prior to seeing him perform in it. At the same time young people are often asked to make choices of occupations they are to follow on the basis of practically no information. Interest in a field may develop only after the individual becomes intimate with the intricacies of his chosen profession and is very often the consequence of skill rather than its motivator.

There are so many different aspects to the field of computing that the student's desired area of specialty must be clearly defined. There is probably no profession in to which computing does not relate in some way and no reason why a student in another field could not, or, indeed, should not acquire some peripheral knowledge of the computing area. However, there are certain prerequisites and abilities for professional computer work. For the blind and perhaps also for the sighted the basic requirements might be summarized by three broad criteria:

1. Professional work with computing is essentially an intellectual occupation. Although this work permits gradation in intellectual demands, at no time is it so manual and routine that it becomes an occupation for the less able and dull. In general, the person who turns toward that field ought to be college level as a minimum. This does not mean that he needs to have had a college education. What it does mean is that he should be of that general material and intellectual quality for which college training is usually recommended.

2. An independent frame of mind is, of course, always a desirable quality for any adult. For the blind trainee this takes on special importance. The blind person who wishes to work in the computer area must be able to function in competition with sighted individuals in this field. This means he needs to have the attitude and adjustments necessary to find his way to his work and to perform it with a minimum of special help.

   Independence is often more an attitude than a skill, although certainly mobility skills are extremely necessary. As in no other occupation, the drive to be independent is almost required of the blind person who wishes to become active in computer work.

3. In making an occupational choice, it is always advisable to look for employability. Employability is very difficult to define. It is probably best to look for factors that would definitely prevent employment before deciding on the applicant's suitability. However, because of the many different opportunities that present themselves in the computer related fields, final employability is probably less important than independ-

ence and intelligence. While a relatively high level of intelligence, an independent attitude toward life in general, and overall employability are the basic guidelines in selection, a number of specific factors must be considered also.

### Age

Age itself is no more a factor in the computing profession than in most other occupations. Placement of older workers is always difficult. Similarly, training of the older individual requires usually more dedication and intelligence on his part than if he were younger. Also, work with computers tends to attract the younger person both because many of its aspects are rather unconventional and because the profession itself is very young. Nevertheless, a number of blind persons over the age of forty have been trained successfully and have found satisfactory positions. It would be desirable however, if applicants over forty years of age could anticipate to return to a previous employer. However, possible effects of aging rather than age itself ought to be sought for. There are also some positive features about the older individual. He may learn more easily and apply better what he knows because of years of experience. It should be recognized that age itself does not set a limit but is a factor to be brought to the attention of the trainee as well as of the selection agency.

### Sex

Sex is not an element in admission standards. Perhaps to a greater extent than in any other profession, computing has opened doors of opportunities for professionally oriented women.

### Marital Status

No standards can be set under this heading. The difference in placement possibilities for men with large responsibilities, persons unable to relocate, etc. should be considered.

## Place of Residence

Persons living in rural or small urban areas should realize that relocation to larger communities may be necessary since employment opportunities for computer programming are limited almost exclusively to large urban centers. The candidate's willingness to relocate may be an important consideration in selecting him for training.

## Medical and Ophthalmological Information

It is extremely important that all possible steps to improve medical and visual conditions are taken before sending the individual for training. Health problems should be under good control. Visual effectiveness should be stabilized at its highest level, including visual aids if they are helpful. The individual should be geared psychologically to the use of the aid. It should be assumed that during training he will have the same medical and visual status he will have during employment.

It is not clear whether the prior possession of useful vision long enough to have visual memories is an advantage in computer work or not. A totally blind student who has no visual memories probably needs a higher level of learning ability than one with good visual memories. On the other hand, there may be certain spatial adjustments especially suitable to work with computers which may be better developed in the person who has never had any vision at all.

The student must be independent in daily living and medical self care. A diabetic should have a stabilized condition and be capable of taking his own injections or making arrangements for them. An epileptic should be accepted only if he can tell that an attack is about to occur and take appropriate action. An individual with orthopedic problems should be able to negotiate steps; reliance on a companion should not be necessary. This does not mean, however, that an individual who can get along only with a companion should be ruled out from training in all instances. A multiply handicapped individual, such as deaf-blind person , may profit greatly by having a skilled companion along during training. Whether or not such a companion will also be necessary during subsequent employment would have to be evaluated after training is completed and will depend largely on the employment opportunity open to that person.

A reasonable estimate of life expectancy may be a factor in the selection of some multiply handicapped. This is true especially for some candidates who are blind from diabetes. Yet, unless productivity of the candidate is obviously limited, there is no evidence that a shorter than average life expectancy will prevent employment in the computer profession. The test of the candidate's physical fittness ought to be whether or not he can do the work demanded of him at the time of selection and during training rather than at some possible future date. The individual's ability to complete a rigorous training regimen may very often serve as a test for "employability" if such a test should be needed.

## Education

A complete educational record should be made available for evaluation. This should include a list of all schools attended and whether they were schools for the blind or public schools. It should be indicated whether the student attended classes without help. A full transcript of at least the last three years of secondary school and any training beyond secondary school should be provided also.

Proficiency in reading and writing Grades I and II Braille is required. So is accuracy in typing or legibility of writing. Accuracy is more important than speed.

While the student should be proficient in reading and writing Grade II Braille, his command of Grade I Braille is also very important. The computer produces a braille which is somewhat different to the touch. It has a sightly less raised appearance and is spaced somewhat further apart. If possible, a sample of the braille printout should be provided so the student's ability to read it can be judged. However, it should be kept in mind that because of unfamiliarity such braille printout is often read with great difficulty for the first few days of use and students invariably improve in this task. The inability to read computer produced braille during testing should not rule out a candidate unless there are obvious reasons why he would not remove this deficiency with additional training.

It is also important to evaluate the educational history of the student in terms of his ability to adjust to whatever kind of scholastic and social demands the schools or colleges have made. Was he the only blind student there? What special attention did he receive? How did he use readers? To what extent did he use braille books? Did he receive special consideration in grades? What were his extracurricular activities? Did he interact with others? The answers to such questions may be important in determining the final employability of the person involved. In evaluating such information the counselor should keep in mind that relationship with people is not necessarily a primary requisite. Many programming jobs are performed in practical isolation. The attitude of the counselor to this type of information ought to be the same as that in evaluating an applicant for any type of technical and professional employment.

The high school diploma is regarded as the minimum requirement for computer training. Good grades in language, shorthand, mathematics, bookkeeping, and related courses are important. In looking at these it ought to be kept in mind that a blind student's school grades are very difficult to evaluate. Both over and undergrading are common occurrences. The fact that the candidate had had certain courses or finished a sequence of them may be more important than the grades he received for his work.

The amount of mathematics the student has or (more likely) lacks is, a problem, of course. On one hand, computing very often requires very little knowledge of mathematics. On the other hand, employers like to find programmers who have a considerable background in mathematics both because this background serves to select the better student and perhaps also the more suitable student for computer work and because occasionally even among the most simple computing demands there are some that require mathematical sophistication. It is clear, therefore, that the better the student's mathematical background is the more easy it will be to train and place him in the computing profession.

It must be recognized that many blind applicants will have less than the usual amount of mathematics that equivalent sighted applicants would have. Such a lack in background ought to be made up during the training itself. However, there are some very basic minima which have to be kept in mind.

The minimum requirement in mathematics is the equivalent of two years of high school algebra and one semester of high school geometry. The student ought to be able to solve simple simultaneous equations. He should know how to deal with fractions, and how to set decimals. He should be able to recall simple geometric and trigonometric relationships such as the relationships between sines or tangents of angles and the sides of a triangle or the distance formula for a straight line as examples. Where the student has passed his high school courses some time ago, it may be desirable for him to review his texts so that he can approach training with some minimum of his arithmetic faculties in working condition.

In using the mathematics background as a criterion in selection, the counselor should inform himself of whether or not a review in mathematics is given in the training facility to which the student is being sent. Sometimes a three to six months review of mathematics in the local high school or with a tutor might prepare the individual to take on further training in computing.

The formal high school diploma is preferred. Equivalent diplomas do not have equal weight in placement.

Where the student appears to be capable of profiting from one or two years of college he should be encouraged to seek such an education prior to becoming involved in computer training. Some college training coupled with computer background will make an individual not only easier to employ but will also better assure his subsequent advancement and promotion within his own line of endeavor. While it is possible to get a job as a programmer without a college degree, most programmers in responsible positions are college graduates.

## Personal Adjustment and Mobility

The student must be independent. Independence is a condition of mind as well as an accomplishment based on a solid support of skills. Cleanliness and grooming must be consistently above reproach and the candidate must be able to maintain his appearance without help. Appearance and behavior must be those of a professional. The applicant must be able to make a good impression in an interview. He must be cooperative, flexible, free from any "chip-on-the-shoulder" attitude. His record should show no major problems in personal relationships. (He should have successfully resolved any problems related to his blindness which might stand in the way of his training or employment. Unpleasant mannerisms sometimes associated with blindness must be corrected if he is to secure and hold gainful employment.)

The mobility of the candidate should be excellent. He must get to his place of work and home without any difficulty. At his place of work, he must move around freely. While no preference between cane or dog exists for outside mobility, it is important to realize that the candidate will have to move around in the confinement of the computing center and offices without an animal.

### Communications

The candidate should be verbally facile, able to express himself clearly, and able to understand verbal descriptions of problems easily. It should be kept in mind that most communications, descriptions of record layouts, printout requirements, and so on will have to be given verbally.

### Employability

A full statement concerning all previous terminations of employment should be provided. Termination should be evaluated on an individual basis but those based on personal difficulties, insubordination, and other personality problems should be examined carefully.

### Goal

A statement of goals should be obtained directly from each applicant and evaluated as part of the total clinical picture.

## Psychological Evaluation

Objective tests should be used to supplement the standard personal, educational, and work history of any good selection program. The three general areas covered by any good basic test battery on which career planning can be founded are general learning ability, interest, and personality. However, in view of the nonverbal nature of the programmer's work and particularly in view of the emphasis placed by certain leading manufactures and users of electronic data processing equipment on abstract reasoning, the recommended test battery is heavily loaded with non-verbal measures of mental ability. Another reason for strongly weighting this aspect of the test battery lies in the fact that all of the tests used to evaluate programming ability are extremely new and relatively unknown. The counselor should keep in mind that to some extent the tests themselves are still being evaluated.

## Measures of General Mental Ability

As a measure of potential for the more academic aspects very necessary to a programmer, the Wechsler Adult Intelligence Scale is recommended. This is a very familiar and widely used test generally acknowledged to have a significant relationship to learning situations of almost any type. The Verbal Scale consists of six subtests: General information, comprehension, arithmetic, digit span, similarities, and vocabulary. (Wechsler, David., Manual for the Wechsler Adults Intelligence Scale., Psychological Corporation, New York, 1955).

During the past years, Drs. Harriette and Phil Shurrager have developed a Haptic Intelligence Scale for the adult blind. Although the authors disclaim any real attempt to parallel the WAIS Performance Scale, they have obviously borrowed concepts from it in developing their test materials. Their normative groups are largely based on the same pattern of selection from the blind population as that used by Wechsler's from the seeing population. The Haptic Intelligence Scale consists of the following subtests: Digit symbol, block design, object assembly, object completion, pattern board, and bead arithmetic. (Shurrager, Harriette C. and Shurrager, Phil S., Manual for the Haptic Intelligence Scale for Adult Blind., Psychological Research, Chicago, Illinois, 1964.)

During the same years Dr. Walter R. Jones developed the Vocational Intelligence Scale for the Adult Blind (VISAB). The VISAB replaces the drawings commonly used in printed tests for seeing people with forms raised out of the background surface of a sheet of plastic. Each VISAB consists of a row of four geometric configurations. Three of the four configurations in any one item share some basic internal or structural relationship or can be grouped by means of a common classification scheme; the fourth is constructed so that this relationship is lacking. In any item the task of the examinee is to discover the underlying relationship either visually or tactually, and to verbalize to the examiner which of the four alternatives does not fit the pattern. (Jones, Walter R., Vocational Intelligence Scale for the Adult Blind (VISAB)., Science Research Associates, Chicago, Illinois, 1964.)

As part of the same research project in which the VISAB was developed, Dr. Alin Gruber developed the Tactual Reconstruction Pegboard (TRP). This is a pegboard divided down the center by a raised bar. On one half of the board the examiner constructs a pattern with pegs; on the other half of the board the subject reconstructs the given pattern, with additional pegs. A subject, in order to reconstruct the given pattern, must determine how it was constructed and where it has been constructed in relation to the pegboard borders. He must then place his pegs in the correct relationship to one another as well as locating them correctly on the pegboard. Additionally, since the decision is left to the subject to signal the administrator when he has completed a given pattern, it is necessary for the subject to check and compare his reproduction with the original pattern. (Gruber, Alin, Tactual Reconstruction Pegboard(TRP)., Dunlap and Associates, Darien, Connecticut.)

There have also been some tests constructed and used to measure directly ability to program. One such test is known as the Programmers Aptitude Test (PAT), by W. L. Hughes and J. L. McNamara. Not much can be said about this test yet except that it has not been tested on enough blind programmers so as to be truly predictive.

## Evaluation of Personal Adjustment

Although qualities of personality and interest might not be regarded as grounds for acceptance or elimination of a candidate (largely because there is too little evidence as yet on what personality types are really desirable) it is important to have some descriptive measure of personality for each candidate. To obtain this the Emotional Factors Inventory may be used. This is a questionnaire type personality inventory consisting of 170 statements and is administered usually by tape recording although the method of administration is a matter of convenience for the examiner. The testee is asked to indicate with which of a number of alternative statements he agrees. The items include some of the familiar material which has already been generally accepted as indicative of personality characteristics in the general population, plus material designed especially to indicate problems arising from blindness. Scores are obtained in seven diagnostic categories:

1. The Sensitivity Scale is designed to show a general instability, the tendency to worry, be fearful, easily upset and to be hurt easily. It shows the probability of brooding over difficulties, responding emotionally and feeling stress more easily than most people do.
2. The Somatic Symptoms Scale is a very short one consisting entirely of questions concerning health difficulties often associated with nervous tensions such as easy fatigue, headache, stomach upset, nightmares, etc.
3. The Social Competency Scale includes items which show both the testee's interest in social contracts and his feeling of security and self confidence in facing other people, especially in groups, his willingness to play a leading part in a group, his ease in talking with others, etc.
4. The scale called Attitudes of Distrust has also been referred to in some previous publications as the Paranoid Tendency Scale. It contains items designed to show the testee's overestimation of himself and his consequent suspicion of others when they do not accept him at his own evaluation. The scale contains questions indicating a general lack of trust for other people, for good intention and others sincerity and honesty.

5. The scale called Feeling of Inadequacy is partially related to the physical handicaps although not necessarily to blindness. It includes items to show the individual's feeling of inability to solve his own problems, his feelings that he is not as good or as capable as those around him, distrust of his own decisions, etc.
6. The Depression Scale may be regarded as a measure of morale, the candidate's hopefulness concerning his future, his belief that something good can still happen to him as opposed to the feeling that life is scarcely worth living.
7. Finally, in the scales called Attitudes and Blindness there are items in which blindness is mentioned. It attempts to measure what the individual feels about such things as running into something, asking the help of strangers to find his way, asking the advice of seeing persons about his dress, daily problems of blindness.

(For details see, Bauman, Mary K., A Manual of Norms for Tests Used in Counseling Blind Persons. American Foundation for the Blind, New York, New York, 1958.)

## Evaluation of Interests

The interest pattern should not be regarded as grounds for elimination or acceptance of a candidate. It is felt that some relationship to success might be uncovered by the scale and that information concerning the applicant's interest pattern should be available for motivational and research purposes.

To this end the very familiar Kuder Preference Record might well be used. This consists of a questionnaire in which activities are presented in groups of three. The testee states which he likes most and which he likes least. The test is scored for the amount of interests in the following nine categories: Mechanical, computational, scientific, persuasive, artistic, literary, music, social service, and clerical. (Kuder, Frederick, Revised Manual for the Kuder Preference Record. Science Research Associates, Chicago, Illinois, 1946.)

In addition to the Kuder, a key, for the Programmer Field, has recently been developed for the Strong Vocational Interest Blank which will inform the testee as to whether his vocational interests are similar or not to the successful programmer. (Perry, Dallis K., and Cannon, William M., SVIB Scores and Programmer Key: Vocational Interests of Computer Programmers. System Development Corporation, Santa Monica, California, 1965.)

### Flexibility of Guidance Criteria

It should be kept in mind that the computing profession represents a very broad field having a great variety of applications and employing a great number of very different people. Individuals seeking work in this field may not be cut from the same cloth nor is it necessary that they all conform to a uniform intellectual and emotional standard. If a selection committee or an advisor is in doubt whether or not an applicant ought to be admitted to training he should probably lean toward admission rather than otherwise. The basic presumption in a democratic society directs any selection body to give the maximum opportunity to anyone who might possibly be able to avail himself of it. However, such a policy has strong limitations if it is followed consistently. The danger exists that a training facility will become overcrowded with individuals who are not really suitable for this type of training. Placing a number of unsuitable individuals into the profession may create a wrong image of blind workers in this field. To some extent these are risks which have to be taken. However, they should also be minimized by remembering that selection is a process that goes on constantly. The fact that an individual has been selected for training does not mean necessarily that he has been selected to continue training or to graduate. A hardheaded attitude during the training period is definitely recommended. The counselor should seek to obtain a record of the trainee's performance during the first two, three, or four weeks of school. If it should appear that the individual is not competent he should be removed from training early. It is recommended, therefore, that the selective process tighten up, so to speak, as training proceeds and that the training facility should be made aware of the fact that washing out a candidate should not be to its discredit. A mechanism should

**exist by which the individual is re-evaluated at frequent and regular intervals during his training period so that steps can be taken to remove him in the event that he should not prove to be suitable for this type of work.**

## III. TRAINING MATERIALS, PROCEDURES AND STANDARDS

Jobs as programmers were defined before as those of coders, business and scientific programmers, and programmer analysts. The coder can be trained in a relatively short time. The business or scientific programmer's job may be filled by an individual who has had direct and intensive training for the business or scientific programmer's job or minimal training (that is, for a coder) plus two to three years of on-the-job training and supervised experience. The job of a systems analyst calls for an individual who has had intensive business or scientific programmer training and at least three years experience on the job, and who has some additional knowledge about the user's fields, such as accounting methods, statistics, applied mathmatics, etc. Work as a systems programmer calls for training and experience not only in programming but also in what is called computer science.

As a consequence, the blind person who wishes to go into this field must define his goals. Training for a coder as a terminal job is not recommended unless unusual conditions favor such a course. However training may be aimed at starting the individual as a coder, with a view to growing on the job.

Where possible and where the candidate appears to have the intellectual faculty to grow with the job, he probably should be trained directly for the job of programmer. This requires an investment of approximately six to eight months.

To become a programmer analyst, the candidate should not only prepare himself to train as a programmer for a year but should also advance his own knowledge in some user's field. This type of training might also proceed from the opposite direction. The candidate could seek or already have a college degree with a major in an applied field (such as accounting, business management, statistics, applied mathematics, etc.) and then acquire an additional year of programming skills.

Finally, for the job of systems analyst the candidate should prepare himself to do graduate work in a computer science department.

## Qualifications of a Training Facility

The Candidate, as well as the agency supporting him, should be concerned with the qualifications of the training facility which offers to teach the necessary skills of programming. Whether this facility is a private enterprise or part of a larger university structure, it ought to have a number of the characteristics to qualify as an acceptable training establishment.

It should not be just a teaching facility but should have wide experience in actual computer work. The most desirable facilities are those that are part of a large research or service center. Such facilities are found as part of private industries or as part of university structures. (As long as the staff do a dedicated job of teaching it does not matter whether they belong to the former or the latter category.)

Where such a training facility must be approved by a state or other agency, the staff of this facility should be evaluated along three broad lines:

1. The teachers should have demonstrated teaching experience in the field of computer programming.
2. They should have the demonstrated experience of having worked with a variety of computer languages in different problem areas.
3. They should show a constructive attitude of working with the handicapped. Information on qualifications of teaching personnel is usually available in the form of curriculum vitae. Constructive attitude toward working with the handicapped can be assessed by interview techniques in which the proper agencies are very well skilled.

Finally, the equipment available to such a teaching institution is of some importance. It should be equipment that is found fairly frequently rather than some off-brand. It should also have the type of underlying systems and software which make it possible to teach blind programmers. This entails also that the on or off line printing equipment should be able to produce a fairly readable braille record of diagnostic and other routines.

It is recognized that some agencies may be reluctant or feel themselves unqualified to evaluate a potential training facility. An evaluation can be obtained on request through this Committee of the Association for Computing Machinery. Arrangements for costs of travel and associated expenditures will have to be made by the agency as the case demands.

### Topics for Training

Diverse teaching and operating conditions existing in various training installations make it impractical to establish and implement a rigid set of specifications regarding course contents for training programs. Yet, agreement is possible on the type of topics on which information is to be imparted to the student without specifying too rigidly the scope of the topics, length of course, or amount of detail covered. A minimal training program will barely touch on many of these topics. A more intense training to prepare the individual for programming jobs will develop the basic topics at greater length.

### General Orientation

Before the blind trainee begins to learn the techniques required for programming, it is necessary that he acquire a broad understanding of what computers are, what they do, how they work, and who uses them. During this short period (one or two weeks) the student is to be introduced to basic processor hardware, peripheral equipment, data communication devices, unit record equipment, and general principles germane to machine language. This sequence should be oriented toward sensing, moving, and working on data. Sufficient demonstrations should occur during this period so that the student can become familiar with the flow of data through its various stages from source to final output.

To help this general orientation along it may be advisable to have the student listen to tapes describing equipment and basic characteristics of programs even before he comes to the training itself. Listening to these tapes is time consuming and can be very easily accomplished before the student comes to the facility.

### Coding and Programming

This section is, of course, the heart of the curriculum and must be properly introduced. Thus, the student should not begin to learn coding principles without having grasped the concepts of internal representation of information, machine distinction between data and instructions, program loading versus execution, and the procedural nature of machine algorithms. With this as a foundation, the following areas can be covered:

1. Program Documentation – This portion of the course should deal with three areas of technical communication. These include principles of flow charting and presentation of techniques specifically suited for the blind programmer, preparation and content of write-ups for finished programs, and methods for receiving and documenting programming assignments.
2. Symbolic Language Programming – A detailed presentation of widely used symbolic languages (such as SPS) should start the course. While not a direct introduction to actual machine language, this exposure serves as a good introduction to machine language concepts without being too violent a departure from familiar language usage. Numerous illustrative and assigned programs and program segments must be included here. Both desk checking and machine debugging techniques should be introduced and used.
3. Machine Language – Once there is some familiarity with command structures, the gap between symbolic and machine language can be bridged. This section should include explanation of absolute addressing and register counters and their interrelation with internal machine operations. Functions and operations of an assembler can then be introduced and discussed. (There is some question as to whether instruction in machine language followed by symbolic language might not be a more effective sequence. The consensus of instructors favors the sequence given here.)
4. Programming in a Problem Oriented Language – Functions of compilers and detailed instruction of the use of a popular problem-oriented language (COBOL, FORTRAN, PL/I, ALGOL, etc.) should now be introduced. The actual language taught in this course segment will depend on the equipment and software available to the training center as well as on its general orientation (that is busi-

ness, scientific, information retrieval). In any event, the teacher's presentation should include a number of examples and assigned programs illustrating the various aspects and capabilities of the language.

### Computing Laboratory

No training center can be deemed acceptable without convenient access to a modern constellation of data processing equipment, including a central processor with on-line high speed input and output devices and basic unit record equipment. The following practical areas in equipment use must be covered.

1. Technical Aids - Use of the card reader, console probe and related devices must be practiced.
2. Use of Unit Record Equipment - Instructions in operating the keypunch, card sorter, interpreter, and other such equipment should be practiced. Sufficient keypunching equipment ought to be available so that the trainees are able to punch their assigned programs conveniently.
3. Computer System Operation - Detailed instruction and extensive hands-on experience including start-up and shutdown procedures, loading of jobs in the card reader and punch hoppers, mounting and removing tape reels, preparing the high speed printer for braille and reconverting it for conventional use, assembling or compiling source programs, use of the utility programs (for listings, card reproductions, etc.) basic console debugging techniques, sources of machine stoppage, and other operating principles should be given.

There are two problems here which ought to be reviewed briefly. Keypunching equipment ought to be available for the trainee so that he can punch his own programs as well as make corrections in program cards during debugging. The programmer will find punching skills useful as he goes on. However, a good deal of attention ought to be paid to the fact that programmers do not, as a rule, punch their own programs. This is done more efficiently and at a lower cost by keypunch clerks. As a matter of fact, having a programmer tie up a machine to punch his own programs would make for a very inefficient operation. Attention must be paid, therefore, to training the student to present his programs to the operator in an easily read form. The programmer trainee should learn to type his programs in such a way that a punch clerk can read them. A programmer may also dictate his program and use a clerk to record instructions in an appropriate fashion. There usually is some resistance on the part of the trainees at this point since it is actually easier during training to punch their own programs than to prepare them for the punch clerk.

The second problem concerns hands-on experience on the computer. Many well run computing centers keep the programmer completely out of the machine room. The programmer never sees anything but the printout of his programs or a machine dump if he so requests. Yet, in some of the smaller installations, the programmer sometimes has access to the machine. Some opportunity, therefore, ought to be given to the blind trainee to learn the console operations for such eventualities. But, even more important, hands-on operation is a pedagogic tool. The programmer gains from console debugging not only a much superior understanding of the operation of programs in the computer but also acquires a psychological advantage by knowing how to do this particular job. Where possible, it is therefore recommended that the blind trainee be given hands-on experience in console debugging.

## Seminar in Computer Technology

Once the trainee has acquired basic coding experience, it is beneficial to go back and fill in the gaps left by the initial brief survey on computing technology. This is best done by a series of discussions designed to give the trainee an overall view of the wide range of activities in which computers are directly involved. Areas of specific interest to the class should be stressed and where possible, augmented by inviting outside speakers. Two areas should be stressed especially:

1. General Hardware and Software Developments - This should consist of a survey of the latest available computing equipment and software including technical descriptions of operating characteristics, cost,

present usages, etc.

2. Areas of Application - Discussion should be undertaken of the fields in which the advantages of computer technology have been established or are being explored. Description of important contributions in these areas are often very helpful to enable the student to see the total field in which he is going to work.

## Field Problems (Practicum)

The training facility may have its own computing jobs or may be able to obtain the cooperation of a business installation in providing the student with some practical experience. By giving the trainee a short program assignment (for which he may even be compensated) the student gains valuable experience in working independently under real operating conditions where he is required to deliver a working program within some specified time.

## Computer Arithmetic

It is true that many levels of programming jobs can be performed without spectacular training in mathematics. Nevertheless, there are basic arithmetic procedures which the programmer must know. These include such trivialities as knowing what happens to decimal points in various arithmetic operations, an approximate understanding of what functions are, knowledge of some of the trigonometric functions, familiarity with algorithmic reasoning, introduction to solution of simultaneous equations, an idea of what matrices are, acquaintance with interpolation techniques, and so on. Basically little more than high school arithmetic is required with perhaps some very low level numerical manipulation techniques in addition. Because of a lack in this type of training in schools for the blind and because blind students are usually channeled away from scientific preparation, it is unusual for the blind person to have even a minimal mathematics background. Where the blind student has had some college training and especially a course in calculus, no extra training is necessary. However, where he has not had this background or where he has had no more than high school mathematics (especially if this had been taught some years before) the training facility ought to include a mathematics review course. Even if some time in the student's computer training has to be set aside for this task, it is a very necessary part of his training.

### Supplementary Training

The material described so far is absolutely essential in producing the coder-programmer who can do routine coding for business data processing or simple scientific application where extensive computation or logical program structure is not required. For higher level programming work additional instruction is recommended:

1. Computation Review – Refresher work in business and scientific computation (depending on the student's educational background and orientation) accompanied by more sophisticated programming and an assignment involving appropriate example computations.
2. Advanced Programming – For those trainees showing interest and demonstrated ability in advanced areas, additional instruction should be given in systems, compilers, languages, and other advanced topics. These instructions should be accompanied by programming assignments of suitable scope and complexity.
3. Special Fields of Applications – Where the student is aiming either for scientific, business, or other areas, he may profitably expand his knowledge in these fields by additional course work.

### Minimal Courses

The curriculum topics described previously can be given with different intensities and for different lengths of time. From a practical point of view, the question may well be what is the minimum time and material necessary to prepare a proper candidate for a job?

A thousand hours of training should be sufficient to prepare an average blind student for the job of coder-programmer. His training should take him through machine language and one problem oriented language, preferably the language in which he will actually work. It should provide a mathematics review where necessary. It should also have a short review on how data are collected, prepared, transmitted, and so on. The survey on hardware and software can be limited to eight to ten hours.

## Extended Training Program

There is probably no upper limit to the training that could be given an individual since in intensive training he may learn as much in three months as he would ordinarily get on the job in one year. Yet, there are some practical limitations to the amount of training that ought to be supported. The minimum intensive training that could be recommended would prepare the blind student for the job of programmer rather than coder. To prepare him for this job about six to eight months training in the major topics would be sufficient. In this period of time the individual can be given knowledge of machine language, SPS, one or two assemblers (such as AUTOCODER and EASY) and two or three user-oriented languages such as COBOL, FORTRAN, or PL/I. The peripheral material can be covered in weekly seminars. Extended training also makes it possible to include discussions or career and professional problems which ought to give the candidate a feeling of orientation and identification with his future occupation.

An intensive extended training period should be patterned after graduate work even though the topics themselves are not discussed on a graduate level. It would be well to give the student access to the facility and equipment for all hours of the day and holidays so that he may use the equipment outside prime time and fit his work into the schedule of the center. In the extended class it is also possible to lead the student gradually away from formal lecture presentation and train him to rely more on his own resources when picking up new languages. This can be done by slowly decreasing the time spent in formal instruction and requiring the trainee to obtain the information from programmers and other personel available in the facility and by reading of manuals. In this way the student can be prepared for the eventuality, which he will meet assuredly, when the facility for which he works replaces its machine with another system which will require an entirely different language.

## Training in Manufacturer's Classes

Manufacturers of equipment offer a basic sequence of instructions for the operation and programming of their machines. These are usually unsuitable to train a blind person who has not had programming experience. They rely very much on visual material, they are oriented toward the use of manuals, they cover a given set of instructions in a very short period of time, and they make no allowance on the initial extra attention and time demands made by blind trainees.

Once a blind person has become an experienced programmer, however, he will find that attending a manufacturer's class to learn a new machine or a different language is almost as easy for him as it is for the sighted colleague. Here the blind programmer can, of course, rely to some extent on his co-workers who may be able to translate a number of the visual materials for him. Also, it is feasible to have special help at that point in translating, coding, brailling, and describing some of the new material.

### Learning to Program in the School System

The blind person who goes to college will find that courses in programming are offered there. He may want to take these courses and make arrangements with the instructors to obtain the necessary help. He can also use the "teammate" technique and get adequate support from the State Office for Rehabilitation of the Blind for this purpose. Where the university or college facility needs brailling techniques and programs that will enable them to use braille automatically they may obtain them through cooperation with this Committee of The Association for Computing Machinery.

Blind students may find it possible to obtain a relatively good background in programming at a college or university so that they can prepare themselves for a career in computer work. This will become increasingly possible as programming training becomes a firmer part of the university's curriculum. There are also some colleges which now give an associate degree in programming (which is essentially a two year degree). Such programs are very much recommended for blind individuals.

For fields such as systems and programming analysis, however, extensive college training is recommended. The individual who wishes to go into a field which, while not programming, specializes in computing, will find that most universities will prepare him adequately so that he can begin working as a programmer analyst. For training in systems work the individual will have to have an aptitude in applied mathematics and logic and seek training through the usual channels of the graduate school in a department of computer sciences.

One more point needs emphasis. Basic programming training will probably be introduced in high schools throughout the country in a relatively short time. Blind high school students, who have the aptitude for such a course, should attend and thus obtain a basic skill on which they may build later on.

### Materials for Training and Work

Some special devices may be difficult to obtain at a reasonable price others may be freely available.

Any light sensitive probe will lend itself to console reading. Such a probe also may be built inexpensively. (See Sterling, et al: Professional Computer Work for the Blind. Comm. of ACM 7: 228-231, 1964.)

The card reader must be precision built and of rugged construction. A mechanical card reader may be obtainable from its original designer, Mr. William Stuebing, Stuebing Automatic Machine Company, 3424 Beekman Street, Cincinnati, Ohio 45223, at a reasonable price.

Copies of reading materials, brailled books, and pamphlets and recordings of books, journals, and relevant articles may be obtained from a large variety of sources. The Jewish Guild for the Blind (1880 Broadway, New York, New York 10023) has available an excellent and extensive library of brailled texts. A good source for recorded materials is Recording for the Blind Inc., 215 East 58th Street, New York, New York 10022.

Translation of suitable materials onto audio tape or into braille is done in many places by volunteers. There are therefore many sources for information. The Committee on Professional Activities of the Blind will supply what current information it keeps on such sources on request.

## Commercial Computer Training Schools

After the Korean War as well as after World War II a number of commercial training institutions sprang up throughout the country whose main purpose was to collect fees and not to give schooling. In many instances these schools were little more than rackets. The same is true today for many programmer training schools. There are many commercial installations throughout the country which profess to give training in programming but are incapable of doing so nor are they really properly equipped. It is very difficult for a student to be trained in such an installation, it is more difficult for him to obtain a job after he has been trained, and it is an expensive undertaking at almost any cost.

Since these schools pose basically a legal problem, neither state agencies nor the Association for Computing Machinery are properly equipped to deal with them. Nevertheless, it should be pointed out to agencies that this type of potential exploitation does exist and will probably be very aggressive in trying to obtain blind students (especially if they can charge them an extra fee).

The Association for Computing Machinery's Committee on Professional Activities of the Blind offers a service here of which an agency in doubt may very well avail itself. If requested to do so, the Committee will survey a training facility which is negotiating with a state agency for training purposes and submit a report to the agency. Also, as an additional safeguard, the Committee will recommend placement for only those facilities which it has had an opportunity to inspect for curriculum, personnel, and other qualifications. This in no way should be interpreted to mean that a school or training facility which has not been accredited by the Committee is not properly qualified to teach. It just means that the Committee has not had an opportunity to take a look at the training procedures offered by that school. The Committee, however, will not recommend placement of a graduate from any training facility which it has not had the opportunity to evaluate. A list of all facilities which have been evaluated and accredited by the Committee may be obtained by any proper agency from the Chairman of the Committee.

# IV. PLACEMENT PROCEDURES

Because of the widespread differences between types of job and employment practices in computer related work, placement procedures and job seeking techniques vary widely from place to place, industry to industry, job to job. Yet, because of the need for highly skilled personnel, all methods of finding employees will be used sometimes.

Advertising in newspapers and journals for all levels of positions from programmers to computing center managers and professors of computer sciences is common. Advertisements of these types, however, are addressed usually to progrmamers with well developed skills and a minimum of two or three years experience. The trainee may expect very little from searching through newspapers or journals and answering ads appearing there. Newspaper advertisements may be used more as hints as to what company seems to be in great need of employees for the purposes of making personal contact later.

Much of the recruiting in industry and universities is done through college level interviews. Industrial organizations in need of high level programmer trainees will try to get them from college campuses, especially among students who have had experience with the campus computing facilities. The help of employment agencies is usually sought only as a last resort. The many commercial schools who claim to train programmers for computer work are usually the last places in which a serious employer will seek programmers unless a particular school has a good local reputation or belongs to a nationally recognized organization.

Professional organizations in the computer field have not found it necessary to set up employment exchanges or other mechanisms by which workers and employers can get together. It may be that in future years these organizations will adopt the same methods now practiced by such allied groups as the American Statistical Association where interviews are set up through the U.S. Employment Service between prospective employers and employees during national meetings. At the present a job exchange is also being established by the Association for Computing Machinery for student members.

Insofar as most facilities feel that they must teach to some extent their own system and practices to anyone they hire regardless of his level of experience, the tendency exists to hire programmers with diverse backgrounds from many sources. Once a likely candidate has been located, his credentials are usually not subjected to uniform scrutiny. In some centers the trainee may be asked whether or not he has acquired certification through a Data Processing Managers Association examination. Very few programmers possess such qualifications, however, and few will seek it after working on a job. Since there are very few places in which programmers as such are trained, no particular school record and other evidence of trained competence usually exists or is asked for.

Most likely the computing center manager will accept the applicant's word that he works at a particular level of competence or accept as proof of competence previous employment with a computing installation. The manager may feel that such laxness in examination of credentials is justified since he expects the first six months to a year of the programmer's work to be essentially in-house training anyhow. If the programmer should turn out to be less than qualified he can be discharged during that period.

This procedure is somewhat different for blind programmers. The blind candidate for employment has to satisfy the manager of the center that his handicap will not interfere in the smooth performance of his own work or that of his co-workers. He must also satisfy the manager that he can perform the programming job at a satisfactory level. The computing center manager or the supervisor will want to satisfy himself personally on both points in great detail before accepting a blind person into his work group.

It should be recognized here that the decision of top management to employ a blind programmer does not automatically lead to employment unless the supervisor in whose charge the blind employee actually will be can be satisfied that the applicant for the job will indeed fulfill all the requirements of a programmer. The amount of sway over the final decision on hiring which the supervisor has should at no time be underestimated by the candidate for a job or by his counselor. In general the determining factor in actual hiring is this supervisor and it is this person whom the blind applicant must satisfy in the final analysis concerning his competence and ability to hold a job.

### Guidelines for Job Interviews

Any job applicant who is blind must be absolutely certain that he is capable of presenting himself in a routine manner without any disadvantage stemming from personal, physical or academic factors.

In appearing for the employment interview with the supervisor, the programmer who is blind should demonstrate total independent mobility. To come to such an interview with an escort for mobility purposes destroys a selling point in the technical "on-the-job" independence of the worker. If the rehabilitation counselor brings the blind applicant to the computing center, he should remain with the receptionist and not be present during the interview. In most modern office establishments the supervisor's secretary will guide the blind applicant to the interviewer's office. It should be stressed that if the interviewee, upon his arrival, demonstrates any degree of personal dependency, he may never have the opportunity to present the facts of his technical competence.

It is absolutely essential that the programmer is acceptably dressed and groomed. Experience has shown that while a potential employer may overlook certain dress and grooming problems of the sighted interviewee, many of the same employers would not accept such problems of the interviewee, who is blind, believing such problems to be undesirable characteristics of the visually handicapped. It should also be kept in mind that computer professionals, as most intellectually inclined white collar workers, prefer a certain type of dress which may be described best as "young executive charcoal grey".

Some of the material covered in the interview will concern the candidate's visual handicap. There is an almost unavoidable curiosity on the part of the potential employer which requires a thoroughgoing verbal exchange during the interview. The interviewee should be capable of presenting information concerning his handicap in a simple straightforward manner, avoiding unnecessarily complicated technical nomenclatures that may be misunderstood by the supervisor. In addition, a major factor in the early exhibition of job suitability is the interviewee's conversational exchange with the potential employer. This does not mean that the job seeker must possess shining conversational abilities. Straightforward answers to questions put to him by the interviewer are usually all that are needed.

A crucial part of the interview will be a thorough examination of the applicant's technical knowledge and ability. Questions will concern most aspects of programming and debugging and the candidate must demonstrate his ability to answer technical questions promptly along a wide range of problems. If the candidate does not know the answer to a particular question, he should state so rather than try to bluff. The chances are that the supervisor knows a good deal about programming and asks questions to which he knows the answers.

The job applicant should not be disappointed if he is not hired on the spot even if his answers are technically correct. Supervisors as well as personnel managers like to reassure themselves and some of their colleagues that the blind applicant is indeed a suitable employee. Therefore, they will proceed in hiring a handicapped person with greater deliberation than hiring the non-handicapped. This is also due partially to the fact that the employer may feel especially reluctant to fire the handicapped as easily as he gets rid of an unsatisfactorily placed nonhandicapped person. It would probably help the employment of most handicapped individuals if their employer understood that they are just as free to discharge them if they should prove to be unsatisfactory as they are to discharge any of their other employees.

The candidate for the job should also realize that many factors besides his own technical competence may decide acceptability for a job. Turndown during a job interview should neither embitter nor discourage a qualified job seeker.

## Guidelines and Responsibilities for Placement

While it is true that the blind programmer must be able to convince his employer of his suitability on his own, in deciding on training and choice of future career he is entitled to the help and assistance necessary for eventual satisfactory employment. Responsibility for employment may be viewed therefore as shared among the applicant for a job, the Vocational Rehabilitation Agency, the training facility, and possibly also by some of the professional organizations to which the candidate may actually or potentially belong.

## For the Blind Professional

Most placement in the computer related profession is done on an individual employee to employer basis. There are a large number of avenues open to the blind person which he can use to contact potential employers. The following are recommended:

1. The candidate for a job should get in touch with the Chairman of the local chapter of the Association for Computing Machinery and solicit his help in suggesting companies who are at the moment on the job market. He should also attend meetings of the Association for Computing Machinery or of similar organizations and get to know his colleagues in the field.
2. The applicant might find it useful to seek information from officers and salesmen of computer manufacturers. While manufacturers of computing equipment do not run a placement service, they have in the past, as part of their community involvement, suggested to the blind programmer possible companies which might be looking for employees.
3. Large industrial concerns have employment offices. Many companies have nonrestrictive policies toward hiring of the handicapped. The names of these companies can be obtained from local and state officers of rehabilitation. The applicant should register and make himself known to these offices.
4. The applicant should seek personal contact with people in the computer profession. A clear statement of his ability and his desire to obtain an interview with an interested employer will very often lead to a desirable contact.
5. The applicant should cooperate fully with his State Vocational Rehabilitation Agency.

There is no doubt that knowledgeable and aggressive job seeking on the part of the blind applicant himself is probably the most productive avenue for employment.

## For the Vocational Rehabilitation Agency

The primary responsibility and activity of the Vocational Rehabilitation Agency is to develop and follow through appropriate employment contacts. The person who is immediately responsible for this contact and for the eventual possible placement of a handicapped client is the rehabilitation counselor.

In actual practice the development of employer contacts for purposes of developing an employment opportunity for a blind programmer is no different from other contacts made in behalf of trained individuals who are ready to work. The primary step in any of these employer contacts is to establish with the employer a favorable policy and interest toward the employment of visually handicapped. The introduction of the employment possibility of a blind programmer is the second step in this effort. The rehabilitation counselor should be prepared to explain to an interested employer how the blind programmer can meet those physical demands of programming that seemingly are in conflict with blindness. It is recognized that such "physical demand vs. blindness" factors have to be learned by the counselor and it may be practical to set up appropriate training programs for counselors in each state.

It is advantageous if the rehabilitation counselor develops the same sort of contacts which have been recommended for the individual job seeker. These should include very prominent contacts with the chapters of appropriate computer organizations especially the Association for Computing Machinery.

Some states have a counselor whose main concern is the placement of handicapped professional persons. He might serve as the key contact with professional computer organizations and aid the local rehabilitation counselor in his efforts.

Undoubtedly, the average rehabilitation counselor in carrying out employer contacts in behalf of a programmer who is blind, will be faced with technical discussion of certain peculiar data processing applications. Rather than enter such discussions ill prepared to represent his placement candidate, the counselor should, if no other resource is more readily available, contact the training facility or an interested computer professional to seek technical assistance.

As placement experience grows, it should also be the responsibility of the rehabilitation counselor to "feedback" information concerning individual placements. In this manner the training facilities, other rehabilitation counselors, professionals in the fields, and blind trainees can be kept aware of changing placement needs and opportunities or of new demands set forth by interested employers.

### For a Training Facility

The facility that undertakes training of blind programmers also acquires some responsibility which goes beyond that of training the student. Its primary responsibility, of course, is to turn out a technically competent product who can present himself to an employer without fear and hesitation. Beyond this, the training facility should be ready to offer assistance in actual placement both to the trainee and to his rehabilitation counselor.

An important contribution of the training facility, in its relation to the rehabilitation counselor, is to provide adequate reports and recommendations. Such reports should indicate facts of personal attributes and technical abilities obtained by the trainee at such time as he has completed the training program.

Because the rehabilitation counselor, in making contracts for clients, may run into technical problems for which he does not know the answers, the staff or management of the training facility should be prepared to assist the counselor from time to time in meeting employer objections or questions concerning a variety of technical aspects in individual placement efforts. Occasionally such efforts may mean intrastate travel and associated expenditures in time and moneys to the training facility. These should be recognized as legitimate costs by the facility prior to offering to undertake training.

A service not directly related to the training program, but vitally important, is that of informing and training rehabilitation and placement counselor staff. Such training sessions could be formal short seminars hosted by one or more training facility or they could be in the form of informal discussion sessions.

Training facilities are usually in close contact with persons in the profession who are acquainted with job needs and may well be able to furnish many valuable job leads to the individual and to his counselor. It may be desirable that the training facility continuously make an effort to maintain such contact for placement purposes. Similarly, the members of the training facility or its management ought to be in close relationship with the Association for Computing Machinery local chapter, this Committee of the Association for Computing Machinery and other professional organizations.

### For the Professional Organizations

The Association for Computing Machinery, as any other professional organization, has the guidance and supervision of employment for all its members as one of its implicit functions. Yet it is not primarily concerned with placement although it may provide such a service to student members.

Through its Committee on Professional Activities of the Blind the Association has taken a unique step of offering to Vocational Rehabilitation Agencies both on the federal and state level as much help as it is possible to render in guiding the placement of blind and well qualified individuals. Whenever this Committee can support the gathering of information on a national level concerning the training and placement of blind workers and the dissemination of such information on the chapter level it will do so. Similarly, the Association through its Committee can keep the Vocational Rehabilitation Agencies duly informed of any new development that might be of interest to them and offer advice on changing trends and practices in the field of data processing that may require modifications and updating of placement and training practices.

The Association for Computing Machinery through its Committee will try to urge local chapter representatives and chapter chairmen to give technical assistance to the rehabilitation counselor and the blind job seeker. What form this technical assistance will take is, of course, up to the local chapter.

The Committee on Professional Activities of the Blind will try to function as an information gathering resource for training facilities and rehabilitation agencies with respect to placement. Information relative to recommended changes in course content, improved teaching techniques, as well as of placement opportunities will be gathered to be disseminated by this Committee to approved training facilities and Vocational Rehabilitation Agencies.

One avenue by which this Committee can render its greatest service in the long run is to insure that the training of blind individuals is performed with necessary dedication and competence. To do so, the Committee will evaluate training facilities and help state agencies to decide upon the suitability of sending candidates to particular places for training. Placement of the blind programmer will become progressively easier as more competently trained blind programmers are in the field. It is recognized that one can never achieve a uniformly high level of training and placement. It would also be a form of abject discrimination to attribute the faults of a few individuals to all other blind programmers. However, as much as possible, it will be and is the intention of this Committee to insure uniform good training opportunities and with it a uniformly good standard of competence of the trained product.

# V. MEMBERS OF THE COMMITTEE ON PROFESSIONAL ACTIVITIES OF THE BLIND

* Mary Bauman
Personnel Research Center
Philadelphia, Pennsylvania

* Ralph Beistline
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania

Robert Dickmann
Johns Hopkins University
Silver Springs, Maryland

Robert Drews
508 N. Grand Avenue
Washington University
St. Louis, Missouri

John Dupress
Massachusetts Institute of Technology
Cambridge, Massachusetts

Robert Gildea
Radio Corporation of America
Burlington, Massachusetts

Marge Hill
ACM Special Interest Groups
Los Angeles, California

* Bernard Krebs
Jewish Guild for the Blind
New York, New York

J. D. Madden
Association for Computing Machinery
New York, New York

* George Magers
Vocational Rehabilitation Administration
Washington, D.C.

* Douglas MacFarland
Vocational Rehabilitation Administration
Washington, D.C.

Eric Mutch
British Computer Association
Cambridge University, England

* Stanley Potter
State Services for the Blind
St. Paul, Minnesota

Seymour Pollack
Washington University
St. Louis, Missouri

* Richard Royston
Computer Systems Institute
Pittsburgh, Pennsylvania

* Philip Sekola
Division of Services for the Blind
Cincinnati, Ohio

Diane Stuebing
University of Cincinnati
Cincinnati, Ohio

* Arthur Voorhees
American Foundation for the Blind, Inc.
New York, New York

* Norman Yoder
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania

* Theodor D. Sterling, Chairman
Department of Applied Mathematics
and Computer Sciences
Washington University
St. Louis, Missouri

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* These are also members of the Committee on Automation and Computation of the American Association of Workers for the Blind with Norman Yoder, Chairman.

## Subcommittees Responsible for Different Parts of This Report.

### Selection of Candidates

Mary Bauman, Chairman
Personnel Research Center
Philadelphia, Pennsylvania

Robert Dickmann
Johns Hopkins University
Silver Springs, Maryland

Douglas MacFarland
Vocational Rehabilitation Administration
Washington, D.C.

Stanley Potter
State Services for the Blind
St. Paul, Minnesota

### Training

Helen Gigley
University of Cincinnati
Cincinnati, Ohio

Lyle Knowles
University of Southern California
Los Angeles, California

Seymour Pollack, Chairman
Washington University
St. Louis, Missouri

Nancy Snyder
Computer Systems Institute
Pittsburgh, Pennsylvania

### Placement

Ralph Beistline
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania

J. D. Madden
Association for Computing Machinery
New York, New York

George Magers
Vocational Rehabilitation Administration
Washington, D.C.

Richard Royston
Computer Systems Institute
Pittsburgh, Pennsylvania

Philip Sekola
Division of Services for the Blind
Cincinnati, Ohio

Diane Stuebing
University of Cincinnati
Cincinnati, Ohio

Norman Yoder, Chairman
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania

### Final Writing Group

Mary Bauman
Personnel Research Center
Philadelphia, Pennsylvania

Seymour Pollack
Washington University
St. Louis, Missouri

Theodor Sterling
Washington University
St. Louis, Missouri

Norman Yoder
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania

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H. Bouman
University of Cincinnati
Cincinnati, Ohio

Hugh Chaplin
Washington University
St. Louis, Missouri

Don Ewart
IBM Corp.
New York, New York

Helen Gigley
University of Cincinnati
Cincinnati, Ohio

Edward Glaser
Massachusetts Institute of Technology
Cambridge, Massachusetts

Abraham Nemeth
University of Detroit
Detroit, Michigan

James Slagle
University of California
Livermore, California